MAST ACADEMY OUTREACH

ELEMENTARY SCHOOL PROGRAM

Adventures Aboard
The
Land SHARC
(Science Hands-On And Related Careers)

Pre-Site Packet

MAST Academy

Maritime and Science Technology High School

Miami-Dade County Public Schools

Miami, Florida

MAST Academy Outreach Programs

Elementary Program

Land SHARC Pre-Site Package

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Land SHARC
Competency Based Curriculum – Grade 5

SCIENCE GRADE 5

I. THE NATURE OF SCIENCE AS INQUIRY
1. Construct an appropriate data table for organizing data.

V. INTERACTION OF SOCIETY AND THE ENVIRONMENT
1. Research quality standards related to the use of soil, water, and air.

VI. SCIENCE AND TECHNOLOGY DESIGN
3. Describe and list some of the tools used by specific science professionals.

MATHEMATICS GRADE 5

I. NUMBER SENSE, CONCEPTS, AND OPERATIONs
7. Translate problem situations into diagrams, models, and numerals using whole numbers, fractions, decimals, and percents.
15. Predicts the relative size of solutions in addition, subtraction, multiplication, and division of whole numbers.
24. Estimates quantities of objects to 1000 and justifies and explains the reasoning.

II. MEASUREMENT
1. Communicates measurement concepts using oral and written language.
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3.10 Uses reading strategies and critical thinking to understand information presented in a story or informational text.

5.II COMPOSITION
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5.III VOCABULARY/WORD STUDY
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5.IV. LISTENING/SPEAKING/VIEWING
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SOCIAL STUDIES GRADE 5

V. CULTURAL AWARENESS
5. Construct tables, charts and graphs.

TEACHER INSTRUCTIONS
Land SHARC Pre-Site Package

***Show the Land SHARC Pre-site DVD to prepare you and your students for the Land SHARC experience. Return the video to MAST Academy, Location 7161 after viewing it.**

1. Make class copies of the pre-site activities. **OMIT THE ANSWER KEYS.**

2. for "Everglades Habitats," prepare the following materials. Write one-half of each word or phrase below on different pieces of colored paper or posterboard. For example, for the word alligator,write **Alli** on a green piece of paper and **Gator** on a blue piece of paper.

3. Have students complete each lesson working individually or in teams.

4. Grade the pre-site activities. (Answer key is provided.) Total the points. This score will be incorporated into a total score for all pre-, on-, and post-site activities. A Participation Data/Certificate request form will be mailed to you after the date of your Land SHARC visit. Record percent scores for all participating students on this form. Certificates of Recognition will be awarded to all students earning a percent score of 80% or above.

5. Aboard the Land SHARC, teams of students will rotate through ten lessons. Before the Land SHARC arrives, divide your class into ten equal teams and assign each team a number from 1 –10. This number indicates where each team will start their Land SHARC adventure.

WORDS TO KNOW

On the Land SHARC, you will need to know several scientific terms in order to understand lessons about marine animals and plants. From the information given to you in each statement below, answer the questions. Circle your answers.

1. Any living thing, plant or animal, is called an organism. Is a rock an organism?
   Yes No

2. An animal that lives attached to a surface and doesn't move around is called sessile. The word mobile is the opposite of sessile. Does a mobile animal live attached to a surface?
   Yes No

3. The back surface of an animal is called its dorsal surface. The opposite of dorsal is ventral. Is the stomach found on the ventral side of an animal?
   Yes No

4. The prefix "octo" means eight. Does an octagon have six sides?
   Yes No

5. Animals that live together in a colony are called colonial animals. The opposite of colonial is solitary. Is an animal that lives alone a solitary animal?
   Yes No

6. The prefix "deca" means ten. Does an animal that is a decapod have 10 legs?
   Yes No

7. An animal that captures food is called a predator. The opposite of predator is prey. If an alligator eats a raccoon, is the alligator the prey?
   Yes No

8. Plankton are microscopic plants and animals that drift in the sea. The prefix "phyto" means plant and the prefix "zoo" means animal. What word can be defined as microscopic plants that drift in the sea? _____

Sometimes scientists need exact numbers as answers. For example, the number of centimeters in a meter is an exact number. Sometimes an estimate or an approximate number is good enough. For example, if you wanted to know how much gas is left in a car's gas tank, an estimate would probably be good enough. Decide if an exact number is needed or if an estimate is good enough.

9. The number of minutes in one hour.	exact	estimate
10. The change you receive from a purchase.	exact	estimate
11. The number of bees in a nest.	exact	estimate
12. The number of shells on a beach.	exact	estimate

CORAL REEF CAMOUFLAGE

Colorful coral reefs, which line the southern Florida coasts, are home to a dazzling diversity of plants and animals. Even the corals themselves that make up the reefs are animals! One of the ways that these plants and animals survive is through camouflage.

Natural camouflage is one of the most widespread and varied adaptations used by organisms to increase their chances of survival and their chances of reproducing. These adaptations help them to find food (prey) and keeps them from becoming food for other animals (predators.)

Some organisms blend in with their environment so that predators overlook them. Some can change their shape in accordance with a change in their surroundings. In addition to these, some organisms throw predators off by disguising themselves as something dangerous or uninteresting.

Read the descriptions below. On the next page are the pictures and the names of some animals that live on the reef and use camouflage to survive. Write the letter of the description underneath the picture that it describes.

A. This animal is astonishingly beautiful wih its gracefully flowing fins, dramatic stripes, and fish-gulping mouth. It is equipped with long venomous spines capable of delivering painful stings upon its prey.

B. This animal has bulging eyes and a large mouth capable of swallowing large prey. Short, thick spines are present on the on the head and sides covering the pectoral fins. These are capable of delivering a powerful, painful and possibly deadly sting.

C. This animal has a large head and long arms with suckers. It is capable of changing its color, size and shape to fit into its surroundings.

D. This animal has eight jointed legs. Other creatures attach to its shell so it can hide from its predators and prey.

E. This animal has two small eyes on top of two stalks sticking up from its head. It uses two large claws to burrow into the sand to hide.

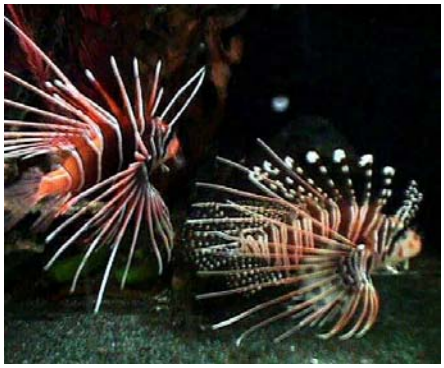
F. This animal is long and thin and has stripes that help it hide in the coral reef.

G. This animal's unusual tail allows it to hold onto seaweed and seagrasses where it hides, looking very much like the plants it uses for cover.

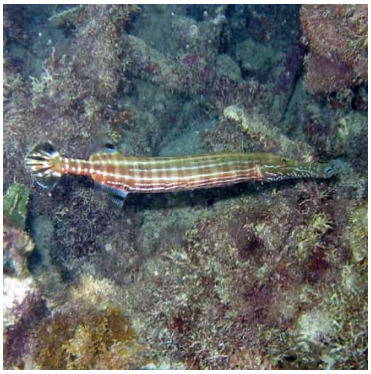
1. Letter ___ decorator crab

2. Letter ___ scorpion fish

3. Letter ___ octopus



4. Letter ___ lionfish



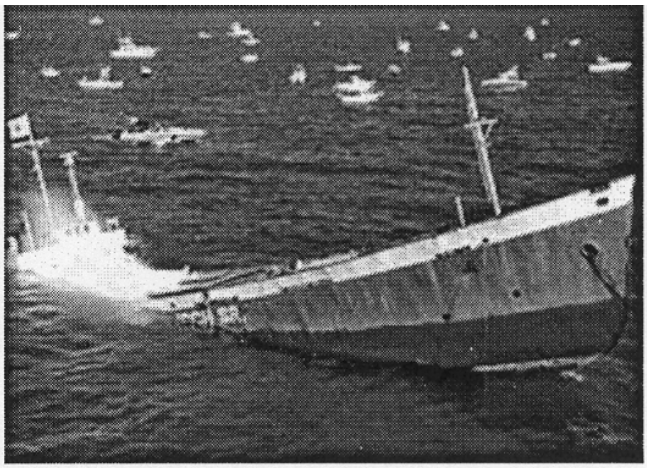
5. Letter ___ trumpetfish

6. Letter ___ ghost crab

7. Letter ___ seahorse

RECONSIDERING ARTIFICIAL REEFS
SCIENTISTS: ARTIFICIAL REEFS MAY DO MORE HARM THAN GOOD

Read the following article about artificial reefs and answer the questions at the end of the article.

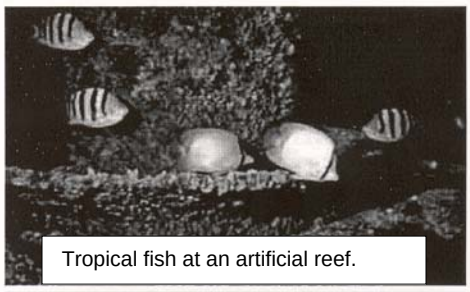


The Adolphus Busch Sr. disappears beneath the ocean's surface, Dec. 5, 1998. The vessel was intentionally sunk to create an artificial reef to take pressure off natural coral reefs and create new marine habitats. (Andy Newman/AP Photo)

To create an artificial reef is to sink a man-made object in the sea, and then allow it to become part of the ocean ecosystem. From old army tanks to school buses to concrete blocks and abandoned oil rigs, artificial reefs come in all shapes and sizes and are popular with coastal residents. Fishermen like them for their ability to attract large numbers of fish in over-fished waters. Conservationists like them for their habitat restoration potential. Scuba divers like them for the diversity of marine life they attract.

Fish Sponges

Artificial reefs, however, may not be such an ideal solution for either the fishermen or ecologists. Artificial reefs attract large numbers of fish for the same reasons natural reefs do: they provide shelter, food, and, some people believe, a place for the fish to reproduce. But as with natural reefs, many fish do not actually use the reefs to reproduce. And even if some fish do reproduce at reefs, many researchers say that these fish are not the fish of interest to sport or commercial fishermen. Most commercial fish, such as snappers and groupers, are simply migrating from natural to artificial reefs. Thus, their populations are being redistributed, not increased. So instead of helping to increase fish populations, artificial reefs may only be concentrating fish populations at their sites.



Tropical fish at an artificial reef.

Fish often occur in even greater numbers at artificial reefs because man-made reefs tend to be larger and provide more shelter. Most fishermen know this and set their lines directly above them. Many people think that because they are catching more fish, the artificial reefs are providing a place where more fish are reproducing. However, according to James Bohnsack, a research fisheries biologist with the National Oceanic and Atmospheric Administration (NOAA), fish that had been spread out over a large area are being concentrated in the areas of artificial reefs. The fishermen catch them, the reef attracts new fish, then the

fishermen catch those, too. "It's like a sponge," he notes. "Squeeze out the water, and it'll soak up more."

Populations Shifting, Not Growing

Other scientists disagree. David Parker, a senior biologist in the marine section of California's Department of Fish and Game, says that artificial reefs may actually help distribute the fishing effort over a larger area. In California, he points out, "a lot of natural reef populations are widely known and are being fished day after day, so the artificial reefs reduce that pressure on a daily basis."

Other scientists, such as Jon Dodrill, an environmental administrator with the Florida Fish and Wildlife Conservation Commission, notes that artificial reefs are such an insignificant part of the ocean floor that they are not doing anything to conserve fish populations. Others feel that they are more harmful than that. Felicia Coleman, a fisheries ecologist at Florida State University, believes that we should not assume that we know enough to artificially recreate a complicated ecosystem. She notes that in places like Alabama – a state with a 38-mile coastline – so many artificial reefs have been sunk that the marine community has completely changed. How changes in marine communities will affect the balance of nature is a question yet to be answered.

Seeking New Designs

Until recently, the "science" of artificial reefs in the United States was anything but science. People bound together old tires or sank a car in an attempt to create their own, personal fish havens. Science, however, is catching up with practice. William Seaman, associate director of Florida's Seagrant Program, says the next step is to create artificial reefs that are beneficial to different species. William Lindberg, a professor of fisheries at the University of Florida, is studying how artificial structures can be designed to be beneficial to grouper populations. William Hernkind, a biology professor at Florida State University, is doing similar research with spiny lobsters.

The Reef Ball - a state-of-the-art "designed" artificial reef

The research of these scientists is grabbing the attention of fis
mentality will not come easily. Many fishermen still believe artificial reefs are producing fish. Dr. Hernkind, disagrees. As a fisherman, he says, "I enjoy them, but I don't kid myself about artificial reefs being a natural enhancement to the environment. I view artificial reefs as fish-attracting devices. As a scientist, however, I'd like to be sure that they're not doing any harm, and in some places I'm not at all sure."

Adapted from an article in The Christian Science Monitor by Lauren Gravitz
http://abcnews.go.com/sections/science/DailyNews/reef000803.html

Questions:

1. Why would fishermen support the use of artificial reefs?_____

   _____

2. Why would conservationists support the use of artificial reefs? _____

   _____

3. Why would scuba divers support the use of artificial reefs? _____

   _____

4. Do artificial reefs actually increase fish populations? (Circle one.) Yes No
   Why or why not? Use information from the article to support your opinion.

   _____

   _____

5. Is biologist David Parker for or against artificial reefs? Why or why not?

   _____

   _____

6. Is environmental administrator Jon Dodrill for or against artificial reefs? Why or why not?_
   _____

   _____

7. Is ecologist Felicia Coleman for or against artificial reefs? Why or why not?

   _____

   _____

8. How is the "science" of artificial reefs being advanced by professors William Lindberg and William Hernkind?_____

   _____

   _____

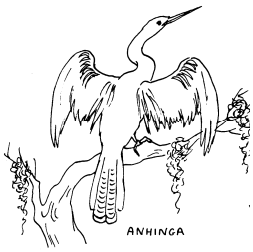
EVERGLADES HABITATS

Directions: Read the following information and then do the activity that follows with your teacher's help.

Sawgrass Prairie

The Everglades is known as the "river of grass." It is the largest expanse of sawgrass in the world. Sawgrass, however, is not a grass at all, but rather a sedge that gets its name from the tiny sharp saw-like teeth on each blade.

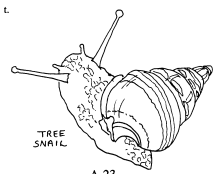
The sawgrass prairie is a freshwater marsh. At one time this "river of grass" was over sixty miles wide at its maximum and extended from Lake Okeechobee to the mangrove estuary. Today it is less than half that size. Approximately two feet deep, the river floods each summer during the rainy season and begins a slow drying process in the late fall. When the water level rises, an algae mat (periphyton) begins to grow. Once the periphyton begins to float, it supports many complex food webs. This is the beginning of many Everglades food chains in the river. Tiny creatures feed on the periphyton and, in turn, larva, small fish such as the mosquito fish, and frogs, such as the pig frog, feed on these creatures. These are food for birds, such as the anhinga and comorant, reptiles, such as turtles and alligators, and larger fish, such as gar and bass. As the water level drops, small pools of water remain in the river of grass trapping thousands of fish which are food for migratory birds that spend the winter in South Florida.

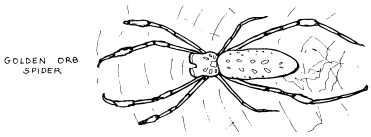


Hardwood Hammock

In South Florida, the name hammock is used to describe a dense, jungle-like forest that contains a variety of trees, many of which are tropical species including Mahogany, Gumbo Limbo, Coco Plum, and Lysiloma. Other species of trees that might grow in a hammock are Live Oak, Red Maple, and Hackberry. The trees are located on a natural rise in the limestone (one to three feet) above the surrounding land. Hammocks seldom flood during the rainy season. The tall trees inside the hammock create a shaded wonderland, allowing small patches of sunlight to filter through which provides the perfect growing place for air plants and ferns.

Animals that can found in a hardwood hammock are golden orb spiders, tree snails, deer, raccoons, and opossums.

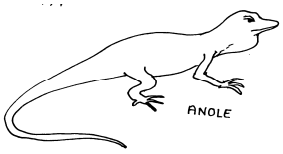




Pinelands

The dominate plant in the pinelands is the slash pine. Growing among the pines are sable palms, palmettos, small shrubs and an array of wildflowers.

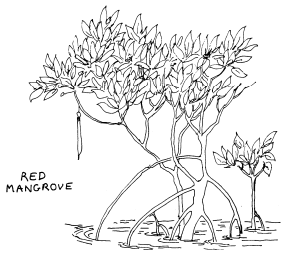
The fern-like coontie plant is one of the more famous residents of the pinelands. The Miccosukee Indians and early settlers collected them for their roots that were processed into starch for bread. The terrain is dry, rough, and rugged. The elevation is approximately six feet above sea level.



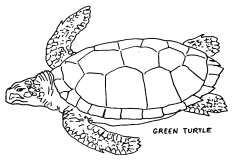
Animals that live in the pinelands include marsh rabbits, raccoons, opossums, and the green anole.

Florida Bay

Where the Everglades “river” drains into the ocean there exists a rich environment with a variety of life. This environment is composed of saltwater marshes, mangrove islands, and a vast open bay. Florida Bay is an 850 square mile estuary south of the Florida Peninsula. It is very shallow, with an average depth of only 4 to 5 feet. The two most important types of plants in this environment are mangroves and seagrasses. Shelter for many creatures is found the tangled roots of the red mangrove or among the dense blades of seagrasses.



The West Indian manatee and the green sea turtle feed on seagrass. A second food chain begins when algae, growing on seagrass and mangrove roots, are eaten by a variety of small animals. A third food chain is started when blades of seagrass and mangrove leaves decompose forming detritus. Detritus is an important food source for shrimp, lobsters, crabs, mollusks, worms, and small fish. These in turn are eaten by larger fish and other species, such as dolphins and manatees.



Directions:

1. Your teacher will give you a colored card with letters on it. The letters spell half of a word or phrase found in the reading on the previous pages.
2. When each student has a card, hold up your card and try to find the other half of the word or phrase in three minutes or less.
3. When time is up, you and the student who has the other half of your word will explain or describe the word.
4. If your card spells the name of an Everglades habitat, stand away from the rest of the students.
5. The remaining pairs of students have cards with either a plant or animal on it. They will then locate and stand behind the habitat in which that plant or animal lives.
6. Discuss whether you agree or disagree with the selections made by each pair.

For the teacher: Below is a list of suggested words to use on the cards.

sawgrass prairie
freshwater marsh
algae mat
mosquito fish
anhinga
reptiles
alligators
bass
Mahogany
Coco Plum
Live Oak
Hackberry
Golden orb spiders
raccoons
pinelands
sable palms
coontie
green anole
mangrove island
manatee
detritus
crabs
mollusks
dolphins
mangrove estuary
periphyton
larva
pig frogs
comorant
turtles
gar
hardwood hammock
Gumbo Limbo
Lysiloma
Red Maple
tree snails
deer
opossums
slash pine
palmettos
marsh rabbits
Florida Bay
seagrasses
green sea turtle
shrimp
lobsters
worms

SANDS OF TIME

Read the information below and answer the questions.

What is sand?
Sand is a small rock fragment commonly made of quartz. Sand comes from the weathering of rock fragments by wind and water.

Why is sand important?
Sand plays an important role in our lives. In the early years of our country, sand was used to make plaster, bricks, and mortar – the cement that holds bricks in place. Sand is the main ingredient used in mixing concrete for the construction of our highways and buildings. Sand is in other things too such as paint, paper, vinyl, plastics and glass.

Look around your classroom.
Name three objects that have sand in them.

1. _____
2. _____
3. _____

Another big use of sand is to restore beaches. Parts of many beaches are lost each year as severe storms cause waves to pull the sand out so far into the sea that it cannot return to the beach. To fix this situation, beaches must be nourished with new sand to maintain their proper width.

Think about the four hurricanes that hit Florida in 2004.
4. Explain why the beaches on both the east and west of Florida may have to be nourished. _____

_____

_____

What is a beach?
Beaches are made up of sand at the edge of a body of water. Beach sand comes from streams and rivers that bring eroded materials to the shore and from waves that constantly hit the shoreline. Beaches range in length from small ones on lakes and rivers to ones hundreds of miles long, like on the Atlantic coast of the U.S. The width of beaches ranges from a few feet on rocky coasts to hundreds of feet on some flat, low-lying coastlines.

What kinds of particles make up sand?
The sediment that makes up a beach can vary from large pebbles and rocks to fine sand and even mud. There may also be different types of minerals in sand. Many beaches in warm climates are made from pieces of coral and

shells from nearby reefs. Wave action on underwater coral deposits tiny bits of coral and shells on the beach.

The shallow waters off the coast of South Florida have coral reefs where many animals with shells such as snails live.

Which two sand samples below may be from a South Florida beach? (Write the letters.)

5. _____ 6. _____

7. Why did you choose these 2 sand samples? _____

_____

Common black minerals in sand are mica and hornblend.

Which two sand samples may have mica and hornblend in them?

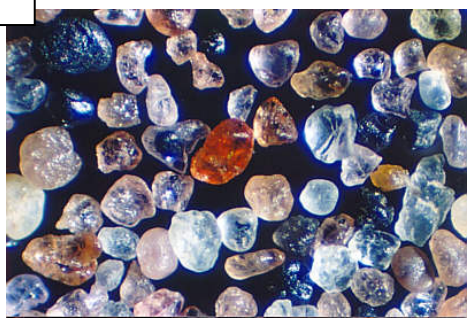
8. _____ 9. _____

10. Why did you choose these two sand samples? _____

_____

A

B



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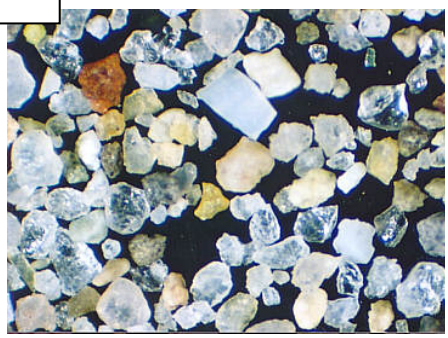

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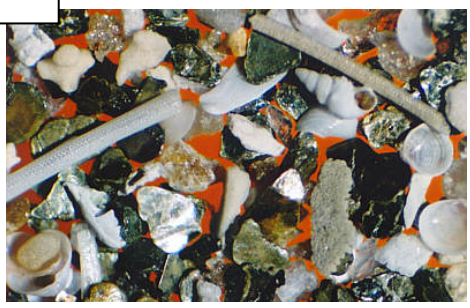


THE WAYS OF WHALE COMMUNICATION

Directions: Read the following information and answer the questions that follow. Then do the Communication Activities with your teacher's help.

Gray Whale

All whales and dolphins are classified as Cetaceans (Se-TAY-Shuns), a subgroup of mammals. Cetaceans make sounds with their bodies and with their voices to communicate. Gray whales seem to be very silent, while the Beluga whale is known as the "sea canary." The male Humpback whale will sing during the mating season for seven to thirty minutes and then repeat the whole song for several hours. Most dolphins speak in short phrases using echolocation clicks and social vocabulary at the same time. Echolocation involves using echoes to locate objects.

Humpback Whale

The body also speaks. Many Cetaceans make a sound by clapping their jaws. Dolphin trainers believe this is a threat or warning. In a quiet mood, dolphins will release one big bubble underwater. The gurgle-pop of the bubbles is believed to be a question. "What's that? Can I share in that?" The bubble is somewhere between curiosity and a request. When a dolphin gets excited, its breathing quickens and each breath forms a distinct "chuff!" – an joyful, high-energy sound.

A whale can use his or her tale to make a variety of sounds. Flukes or tails are wiggled on the surface in anxiety or annoyance. When there is danger, the flukes are slapped against the surface, producing a very loud crack. This is called lobtailing. This crack can be heard for miles in the ocean and will cause other Cetaceans in the area to dive directly down. Cetaceans may also breach, jump part or all the way out of the water, and then belly-flop or sidesmack the surface.Sometimes breaching is for danger or a warning; sometimes it may serve to knock lice off, other times it seems to be for fun.

Whale Fluke

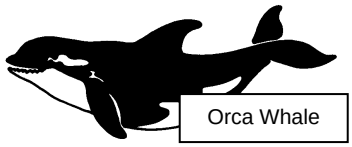
The vocal sounds of whales have been categorized into two types: pulsed sounds and pure tones. Pulsed sounds or clicks include sonar or echolocation sounds (using echoes to locate objects), faster clicks used for social communication, and repeated sounds or clicks which are thought to be "self-expressive" which means we can't figure out what the whales are saying to each other.

The pure tones sound like clear whistles. They are beautiful bird-like sounds. Each whistle is particular to a species. A bottlenose dolphin will always recognize another bottlenose dolphin. More important, each whistle is individualized, like a signature or a name. Even more surprising, it seems that

the Cetacean community is so integrated that an individual of one species can recognize and communicate to an individual of another species. Thus, Moby Dick the Sperm Whale can cross-communicate with Emus the Orca Whale.

Bottlenose Dolphin

Dolphins are born with their own personal whistle. Whenever the whistle is given, it is answered by a nearby Cetacean. The whistle seems to provide a great deal of information: the location of the whistler, the identity of friends, the whereabouts of companions, and the desire to hear a response. Choruses of whistles may be a way to confirm the mood, state of being, or purpose of the group. For example, Orcas often vocalize intensely just before setting out to hunt, and then keep in contact with clicks and whistles while herding fish or hunting cooperatively.



Orca Whale

Questions: What would your interpretation as a biologist be if you heard:

1. A 10-minute pattern of singing underwater with grunts, squeaks, moans, etc. which is repeated in sequence._____

2. A minke whale lobtailing slapping its flukes against the water with a loud smack. _____

3. Clicks repeated over and over again in an area where there are whales. _____

4. Two bottle-nosed dolphins whistle to each other, each with a distinct whistle. _____

5. A group of Orca whales vocalizing a great deal and then occasional whistles and clicks._____

Communication Activities:

Talk and Listen Like a Dolphin

Dolphins make fast, high pitched clicks that bounce off objects around them. They can make clicks and listen to their echoes at the same time

they hear clicks and sounds made by other dolphins without getting confused. Your teacher will pair you with another student. Each of you is think of a story to tell each other. Start talking at the same time, telling your story to each other.

Class Discussion:

1. Were you able to listen to your partner without stopping your own story? Why or Why not?

Use Sound Like a Group of Whales

Your teacher will put you in a group with 6 or 8 classmates to form a pod of whales. Close your eyes and say “hello” softly, over and over. Try to listen to the other “hellos” and figure out whose voice is whose. Use the sounds as a way of telling where everyone is and try to move around together.

Class Discussion:

1. Were you able to identify your classmates from their “hellos?”
2. Were you able to move around together as a group?
3. What could you do to improve your “whale” communication skills?

SHARK TEETH

Sharks may have up to 3,000 teeth at one time. These teeth are modified placoid scales that have the same structure as a tooth, having an outer layer of enamel, dentine and a central pulp cavity.

The teeth are arranged in rows; when one tooth is damaged or lost, it is replaced by another. Most sharks have about 5 rows of teeth at any time. The front set is the largest and does most of the work. Behind the front row of teeth is a second smaller row of teeth, then a third row, and a fourth and a fifth. The last row of teeth, the smallest, is positioned almost flat against the shark's mouth. As a front tooth is broken or worn down, it falls out and is replaced by a tooth in the next row.

Most sharks do not chew their food, but gulp it down whole it in large pieces. Therefore, their teeth are used to tear food into mouth-sized pieces.

SHAPES
Sharks teeth come in many different shapes and sizes, as they are used to catch and kill different prey.

Write the letter of the tooth description in the box under the picture that it best describes.

1. Some sharks have thin, pointed, sharp, knife-like teeth designed to catch and hold slippery fish.

2. Many bottom-dwelling sharks have thick conical or flattened teeth with large serrations (jagged edge) that are used for crushing crabs and mollusks.

3. Some sharks have teeth that are very sharp, wide, wedge-shaped, and small serrations designed for catching and tearing apart prey.

Shark Math

4. In ten years, an average Tiger Shark can produce as many as 24,000 teeth. How many teeth does a Tiger Shark produce in one year?

_____

Explain how you reached your answer. _____

_____

5. The tooth of the ancient shark, Megalodon, is three times as large as the tooth of a great white shark. If the tooth of a great white shark is 2 inches long, how large is the tooth of a Megalodon?_____

Explain how you reached your answer. _____

_____

6. During the summer, the front row teeth of a nurse shark are replaced every 2 weeks. If there are 13 weeks in a summer, what is the average number of times the front teeth are replaced in the summer?

_____

Explain how you reached your answer. _____

_____

7. The whale shark can be 60 feet long. How many inches long is a whale shark?_____

Explain how you reached your answer. _____

_____

8. If a dwarf shark is 6 inches long, how many times longer is the whale shark? _____

Explain how you reached your answer. _____

_____

BUOYANCY

Constructing an Aluminum Foil Boat

When an object floats, it is said to have positive buoyancy. An object can be made of materials that are heavier than water, but there must be air or space inside the object in order for it to float. The amount of air or space inside the object is also called volume. Since the air doesn't weigh as much as the water, this lowers the weight of the object compared to the same volume of the water it displaces. When the air inside an object is replaced by weight, the object will sink and is said to have negative buoyancy.

Challenge: Given the materials below, build a boat that will hold the most pennies and still float.

Materials:

10 x 10 cm piece of aluminum foil
30 cm piece of scotch tape
scissors
container of water
pennies
ruler

Team Directions for building a boat:

1. Cut a piece of foil 10cm x 10cm. Place a ruler over the foil at the position you want to make the cut. Then pull the edge of the foil up so that the foil cuts from one end to the other.
2. Cut a piece of tape 30cm long.
3. Shape the foil into a shape you think will hold the most pennies. You can use any object, such as the bottom of a container, as a template or mold.
4. Use the tape to hold your boat together or to increase the boat's height.
5. Now test your boat in the water. Keep adding pennies until it sinks. Record the number of pennies it holds.
6. The team boat that holds the most pennies wins a prize.
7. Now you will use Excel to create a data table and a bar graph for the number of pennies held by each team's boat. Your teacher will show you how to calculate the mean (average), median and mode.

Analysis:

1. When did the aluminum boats have positive buoyancy?
   _____
2. When did the aluminum boats have negative buoyancy?
   _____
3. Describe the shape of the winning boat.
4. Why do you think this boat held the most pennies?
5. What could you do to your boat so that it will hold more pennies? (If there is time, try it!)

Source:
http://www.engineering.usu.edu/jrestate/workshops/buoyancy/boats.html
Building Foil Boats. 2/22/2007.

Internet Websites for Additional Resources for Buoyancy:

Buoyancy
http://hyperphysics.phy-astr.gsu.edu/hbase/pbuoy.html

Interactive Buoyancy Lessons
http://www.onr.navy.mil/focus/blowballast/sub/work2.htm

Stability
http://powerboat.about.com/library/weekly/aa061903a.htm

Buoyancy Explorer
http://www.seed.slb.com/en/scictr/lab/buoy_exp/index.htm

Submarines
http://www.howstuffworks.com/submarine.htm

Floating and Stability
http://www.seed.slb.com/en/scictr/lab/floating/index.htm

Dancing Raisins and Bubbles
http://pbskids.org/zoom/activities/sci/dancingraisins.html

ANSWER KEYS (TOTAL 100 POINTS)

Words to Know (12 total points – 1 for each question)

1. No
2. No
3. Yes
4. No
5. Yes
6. Yes
7. No
8. phytoplankton
9. Exact
10. Exact
11. Estimate
12. Estimate

Coral Reef Camouflage (14 total points – 2 for each answer

1. Letter D – decorator crab
2. Letter B – scorpion fish
3. Letter C - octopus
4. Letter A - lionfish
5. Letter F – trumpetfish
6. Letter E – ghost crab
7. Letter G - seahorse

Reconsidering Coral Reefs – (16 total points – 2 for each question)

1. Fishermen like them because they attract large numbers of fish.
2. Conservationists like them because restore habitats.
3. Scuba divers like them because they attract a diversity of marine life.
4. No. Most types of commercial fish do not reproduce at the reefs. Fish simply migrate from natural to artificial reefs because man-made reefs tend to be larger and provide more shelter. This is not increasing the fish population. It's just moving the populations around and concentrating them in another area.
5. David Parker is for artificial reefs. He says they help distribute the fishing effort over a larger area. It reduces the pressure on natural reefs where fishing takes place day after day.
6. Jon Dodrill is probably neutral because he thinks that they are too insignificant to make a difference in conserving fish populations.
7. Felicia Coleman is against artificial reefs. She thinks they are changing the marine environment and this may upset the balance of nature.
8. William Lindberg is studying how artificial reefs can be designed to be beneficial for grouper populations. William Hernkind is designing artificial reefs to do the same for spiny lobster populations.

Everglades Habitats – (8 total points)

Give each student 8 points for describing word on card and being in the right habitat.

Sands of Time (10 total points – 1 for each question

1. – 3. –Answers will vary but can include notebook paper, plastic ruler, glass window, drinking glass, paint on walls or for art work, anything made of vinyl or plastic.
4. The force of the waves and winds of the hurricanes probably pulled sand out to sea or swept it up the beach.
5. and 6. A and D
7. They have shells in them.
8. and 9. B and D
10. They have black particles which may be mica and/or hornblend.

The Ways of Whale Communication –(10 total points; 2 for each question)

1. It is likely a male Humpback, probably during mating season.
2. This is likely warning others of danger.
3. These could be "self-expressive" clicks so I wouldn't know their meaning.
4. They are probably identifying themselves to each other, and signaling their location.
5. They are preparing to hunt cooperatively and then keeping in contact.

Shark Teeth – (16 total points; 2 for each question)

2

1

3

4. 2, 400 teeth in one year - Divide 24,000 by 10.
5. 6 inches long - Multiply 3 times 2.
6. 6.5 is average number of times the teeth are replaced in summer. Divide 13 by 2.
7. 720 inches – Multiply 60 times 12 inches.
8. 120 times as long – Divide 720 inches by 6 inches.

Buoyancy - (14 total points; 2 points for questions 1 and 2; 3 points for questions 3 and 4; 4 points for questions 5)

1. The boats have positive buoyancy when they are floating.
2. The boats have negative buoyancy when the sink.
3. Answers will vary but boat that has largest volume should hold the most pennies.
4. Answers will vary but boast with greatest amount of space inside will hold the most pennies.
5. Answers will vary but should include making more space or air or volume inside so boat displaces more water. This would allow boat to hold more weight.

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